

# Memorandum

F1-188

Date : July 28, 1997

To : Lester Snow, Executive Director  
CALFED Bay Delta Program  
1416 Ninth Street  
Sacramento, California 95814

From : Department of Water Resources

Subject : Category III Proposal

Enclosed please find a project proposal in response to the CALFED Bay Delta Program Category III Request for Proposals. This proposal is entitled: *Sacramento River Geographic Information System: Public Access, Data Development and Exotic Species Mapping*.

This proposal is one of three proposals related to ecosystem and natural process restoration along the Sacramento River being submitted by the California Department of Water Resources, Northern District. The other proposals, also being submitted today, are entitled: *Upper Sacramento River Fisheries and Riparian Habitat Management Program (SB1086) Implementation: Watershed Management Planning and Ecosystem and Natural Process Restoration on the Sacramento River. A Quantitative Characterization of Conditions Required for Riparian Forest Establishment*.

Thank you very much for your consideration. If you have any questions, please call me at (916) 529-7342.



Naser J. Bateni, Chief  
Northern District

Enclosure

FI-188

## **I. Executive Summary**

### **a. Project Title and Applicant Name**

The California Department of Water Resources (DWR) Northern District is submitting a proposal for *Sacramento River Geographic Information System: Public Access, Data Development, and Exotic Species Mapping*.

### **b. Project Description and Primary Biological/Ecological Objectives**

This project is for the development of public access, new and updated data layers, and continued data management of the Sacramento River Geographic Information System (GIS). This GIS supports the technical efforts associated with the goal of the Upper Sacramento River Fisheries and Riparian Habitat Management (SB1086) Program, to preserve and reestablish a continuous riparian ecosystem along the Sacramento River. The project involves cooperation with the California Environmental Resources Evaluation System (CERES) in the development of an interactive GIS site on the Worldwide Web; updating data in the GIS on channel alignment, bank faces, rock revetment, levees, land ownership and erosion projections; developing new data layers of critical information such as the distribution of invasive exotic plant species, primarily giant reed (*Arundo donax*); developing standard metadata for public use; and, coordinating with the California State University, Chico Geographic Information Center (GIC) on using the GIS for map development for site-specific planning and other projects under the SB1086 program. This project will be implemented by DWR staff in close cooperation with the SB1086 Advisory Council, which includes state and federal agencies, public interest groups, and riparian corridor landowners.

The primary biological and ecological objectives of this project are to further the goal of establishing a continuous riparian ecosystem along the Sacramento River by supporting the SB1086 program, and fostering a broad-based understanding of the system on the part of managing agencies, private landowners and the public at large. The GIS provides a foundation for the integration of knowledge and studies on a host of issues related to Sacramento River ecology. This project build upon and updates the GIS, supporting both scientific research and public understanding of ecosystem stressors, including: loss of riparian forests, shaded riverine aquatic habitat, and eroding banks; erosion rates and locations, including the amount of spawning gravel released into the system; presence and distribution of invasive exotic plant species such as giant reed; changes in channel form and alignment; alterations to the river floodplain; analyses of hydrologic changes; the presence of infrastructure including levees and bank protection; and, the ownership of riparian lands

### **c. Approach/Tasks/Schedule**

The project includes: interactive GIS Web Site development in cooperation with CERES, utilizing Environmental Systems Research Institute (ESRI) Internet Extension software; updating data layers utilizing information from a variety of sources; developing new information through field data collection; development of metadata, and coordinating with (GIC) on map development.

Prototype Web Site development, data updates, and field data collection of bank face types, and invasive exotic plant species, will occur during the first year. In the second year, the interactive GIS Web Site will be up and running, further data updates will occur, and all new field data will be available through the GIS. Work with the GIC as well as metadata development will occur throughout the project period.

**d. Justification for Project and Funding by CALFED**

An up-to-date and readily accessible GIS is a key component of ongoing education, coordination, and planning efforts needed for the preservation and establishment of a continuous riparian ecosystem along the Sacramento River, and is integral to research and understanding of system stressors.

**e. Budget costs and third-party impacts**

DWR requests \$273,400 for this project. It is not anticipated that there will be any third party impacts associated with this project. All field data collection on private lands will be carried out with landowner permission.

**f. Applicant qualifications**

DWR has developed the existing Sacramento River Geographic Information System, serving as staff to the SB1086 process. Engineers and environmental specialists within DWR are knowledgeable of and experienced with a wide range of GIS-related issues, hardware and software. Department engineers, geologists and environmental specialists are experienced in field collection of biological, physical and geological data, and in the use of differential GPS units. Department botanists have up-to-date knowledge on invasive exotic plant species and vegetation mapping techniques.

**g. Monitoring and Data Evaluation**

Annual progress and financial reports will be provided describing tasks accomplished for each phase of the project.

**h. Local Support/Coordination with other Programs/Compatibility with CALFED Objectives**

This program provides up-to-date and accessible information supporting river-oriented programs, including SB1086, research efforts by the University of California at Davis, and California State University, Chico, and state and federal agencies. The program also provides information to river landowners, interest groups, students, and the general public.

Approximately \$100,000 per year is budgeted by DWR Northern District on Sacramento River database development and maintenance. GIS database and Web Site development included in this proposal would be in addition and complementary to this existing Northern District program.

**II. Title Page**

**a. Title of Project**

*Sacramento River Geographic Information System: Public Access, Data Development, and Exotic Species Mapping*

**b. Name of applicant/principal investigator(s); address; phone/fax/E-mail; organizational, institutional or corporate affiliations of applicant/principal investigator(s)**

Stacy Cepello, Environmental Specialist  
California Department of Water Resources  
Northern District  
2440 Main Street  
Red Bluff, CA 96080

Phone: (916)529-7352  
Fax: (916)529-7322  
E-mail: cepello@water.ca.gov

**c. Type of organization and tax status**

DWR is a state agency.

**d. Tax identification number and/or contractor license, as applicable**

DWR's tax identification number is 52-1692634

**e. Technical and financial contact person(s), address, phone/fax/E-mail**

Barbara Polson, Administrative Officer  
California Department of Water Resources  
Northern District  
2440 Main Street  
Red Bluff, CA 96080

Phone: (916)529-7339  
Fax: (916)529-7352  
E-mail: polson@water.ca.gov

**f. Participants/collaborators in implementation**

California State University, Chico Geographical Information Center (GIC)  
California Environmental Resources Evaluation System (CERES)

**g. RFP project group type:**

Other Services

### III. Project Description

#### a. Project description and approach

This project is for the development of public access, new and updated data layers, and continued data management of the Sacramento River Geographic Information System. This system supports the technical efforts associated with the Upper Sacramento River Fisheries and Riparian Habitat Management (SB1086) Program. The goal of the SB1086 program is to preserve and establish a continuous riparian ecosystem along the Sacramento River. The Sacramento River GIS focuses on the Sacramento River between Keswick Dam (River Mile 243) and Verona (River Mile 87) and provides a foundation of information supporting a host of investigative efforts into stressors of the Sacramento River ecosystem. These include the extent, location and type of riparian forest, extent and location of shaded riverine aquatic (SRA) habitat, changes in channel form and alignment, alteration of the floodplain, and analyses of hydrologic changes.

Interactive GIS Web Site. The development of the Sacramento River GIS Web Site will be carried out in cooperation with CERES, as well as with local agencies, public interest and private landowner groups associated with the SB'086 program. Links will be provided to the Web Sites of agencies and groups involved in Sacramento River riparian corridor management, to tributary watershed efforts, and to programs such as the GIC, the Sacramento River Discovery Center in Red Bluff, and the California River Assessment Program. The Web Site will provide for interactive on-screen use of data in the GIS, as well as for the downloading of data files and metadata.

Channel form and alignment. Considerable channel movement along the Sacramento River has occurred since 1991, which is the most recent channel alignment in the GIS. Development of data on current channel alignment will utilize digitized aerial photography taken in May 1997. If channel form and alignment changes significantly during the flood seasons of 1997/98 or 1998/99, aerial photography will be taken of the new channel, and the information digitized and inserted into the GIS.

Exotic Plant Species. Exotic plant species, including giant reed (*Arundo donax*), tree-of-heaven, (*Ailanthus altissima*), eucalyptus (*Eucalyptus* sp.) and tamarisk (*Tamarix* sp.) will be mapped by boat using hand-held GPS units. Significant patches of such species that cannot be accurately mapped by boat will be mapped on foot in those locations where access is permitted by private landowners. Interviews will be conducted with private individuals and agency personnel familiar with the riparian corridor to determine where significant patches exist that are not visible by boat. Location data recorded in the field will be converted into files for insertion into the GIS.

Shaded riverine aquatic habitat (SRA) and other bank face types. Bank face types, including SRA, bare eroding banks, gravel bars, and rock revetment, will be determined by boat. Data will be collected using standards developed by the U.S. Fish and Wildlife Service, the California Department of Fish and Game, and DWR. Data will be recorded using hand-held GPS units, and standard paper data sheets. Information will be converted into files for insertion into the GIS.

Infrastructure. The most current information on rock revetment and levees will be gathered from flood control agencies, and using field data collection. In some areas, private

levees will be mapped using hand-held GPS units. This digital information will be converted to files for insertion into the GIS.

**Ownership.** Ownership data will be updated using property data purchased from County Assessor office or from private vendors providing such information. Existing database records will be updated using an established update routine. Updated information will be converted to ArcView for ease of viewing and retrieval.

**Metadata.** Development of standard data will focus on making the data layers easily understandable and useable by the general public. Standard descriptions of data available at the Web Site, including source, accuracy, digitizing date and method, and intended use, will accompany each data layer present on the Web Site GIS. This metadata will also be supplied to the GIC for use in cartographic projects, including the development of maps for site-specific plans and other projects associated with the SB1086 program.

**b. Location and/or geographic boundaries of project**

The Sacramento River Geographic Information System focus on the Sacramento River between Keswick Dam (River Mile 243) and Verona (River Mile 80). This area includes portions of seven counties: Shasta, Tehama, Butte, Glenn, Colusa, Sutter and Yolo. The GIS focuses on the Sacramento River Conservation Area, a riparian corridor encompassing over 200,000 acres.

**c. Expected benefit(s)**

Because of the complexity of the Sacramento River ecosystem, an up-to-date and readily accessible spatial database of physical and biological information is critical to its analysis and understanding. A current and accessible GIS system facilitates communication between the various interests within the Sacramento River Conservation Area. The system can be used to promote an understanding of the entire system as well as the dynamics at work on a particular site on a meander bend. Up-to-date information on channel alignment, bank face characteristics, rock revetment locations, and exotic species presence lays the groundwork for site-specific planning with private landowners and cooperating agencies under the SB1086 program.

**d. Background and Biological/Technical Justification**

The Sacramento River GIS was developed under the Upper Sacramento River Fisheries and Riparian Habitat (SB1086) Program to provide a clearinghouse for data on the Sacramento River. Currently, the system operates using Geo/SQL, Spatial Analyst, and ArcView software. Thirty-four layers exist in the system, and include physical and biological parameters, as well as human features on the landscape, such as ownership patterns, infrastructure, levees and bank protection. The GIS has been a critical tool in the development of an understanding of how the river works on the part of the agencies, community groups, and landowners along the river. Ensuring that this understanding and communication continues requires: improving the accessibility of the GIS through the worldwide web; adding critical data on threats to the ecosystem such as the spread of

detrimental exotic plant species; and, ensuring up-to-date information on such critical factors as channel form and alignment, erosion projections, bank face characteristics and ownership.

Interactive GIS Web Site Wise management of the Sacramento River ecosystem depends not only on state and federal policy, but on education and awareness of the system on the part of the broader public community. The Sacramento River GIS Web Site will provide valuable information on the system, links to other groups and agencies along the River, and an opportunity to download spatial information on a wide variety of physical and biological features, to use for a wide variety of planning efforts associated with the ecosystem.

Channel form and alignment Because of the dynamic nature of the Sacramento River, channel form and alignment changes frequently, particularly in seasons with significant flooding, such as 1994/95 and 1996/97. The most current channel alignment information should be available to agencies and private individuals involved in riparian habitat management along the river.

Exotic Plant Species Giant reed and other invasive nonnative plant species such as tree-of-heaven, eucalyptus, and tamarisk are present in increasing numbers within the riparian corridor of the Sacramento River and its tributaries. In particular, giant reed may degrade riparian systems by displacing native riparian species, altering the forms of food and cover to which native riparian wildlife species have adapted. The plant is adapted to fire, burns easily when dry, and can quickly spread downstream during flood events. In addition, studies show that the plant utilizes significantly more water than native plant species. While efforts are underway in Southern California and the San Francisco Bay Area to study and control the spread of giant reed, there has not yet been a comprehensive effort made to assess the problem in the Sacramento Valley. This project will provide baseline information on the presence of giant reed and other species along the main stem of the Sacramento River, and should be used in conjunction with the efforts of tributary watershed groups within the Sacramento River watershed to assess the presence and distribution of these species. The conversion of the data to readily-accessible files available on the Sacramento River GIS Web Site will facilitate this coordination.

Shaded Riverine Aquatic (SRA) Habitat and other bank face types. Part of the habitat diversity resulting from a meandering river ecosystem is due to the diversity of habitat types along the water's edge. Along the Sacramento River, this includes shaded riverine aquatic (SRA) habitat, bare cut banks, and gravel bars. These features are important for the development of site-specific management plans along the river.

Ownership. Land ownership is subject to frequent change, and the most up-to-date landowner information is key in carrying out many types of studies along the Sacramento River. This information in the GIS has been used by many parties; in the last year, such information has been used by researchers with the University of California at Berkeley, and at Davis, the California State University, Chico, and by the U.S. Fish and Wildlife Service, the U.S. Bureau of Land Management, the California Department of Fish and Game, the California Department of Parks and Recreation, private individuals, and the SB1086 program.

Infrastructure. Infrastructure such as levees and bank protection play an important role in channel form and alignment as well as changes to the floodplain. New levees and bank protection, or changes in the portions that are currently installed, are particularly numerous in seasons with significant flooding, such as 1994/95 and 1996/97. The most

detrimental exotic plant species; and, ensuring up-to-date information on such critical factors as channel form and alignment, erosion projections, bank face characteristics and ownership.

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Infrastructure Infrastructure such as levees and bank protection play an important role in channel form and alignment as well as changes to the floodplain. New levees and bank protection, or changes in the portions that are currently installed, are particularly numerous in seasons with significant flooding, such as 1994/95 and 1996/97. The most



current information on such structures is very important for effective planning along the river.

Metadata. Good metadata is key to the successful use of data on the Sacramento River. Metadata to be provided over the Internet to public users of the Sacramento River GIS should be standardized, practical and easy to use and understand.

**e. Proposed Scope of Work**

**Phase I (first year)**

- Work with CERES to develop prototype Web Site using key data layers
- Development of interactive GIS for use with Web Site
- Conduct field mapping of detrimental exotic plant species
- Conduct field mapping of bank face types (including SRA, bare eroding banks, gravel bars, and rock revetment)
- Update channel alignment
- Update erosion projections
- Develop standard metadata
- Coordinate with GIC on map development using GIS data

**Phase II (second year)**

- Completion of interactive GIS Web Site
- Exotic plant species data available in GIS and on Web Site
- Bank face type data available in GIS and on Web Site
- Update channel alignment as necessary

**f. Monitoring and Data Evaluation**

A yearly progress report will be submitted outlining status of the above tasks.

**g. Implementability**

This project is in compliance with local, state and federal law. Channel alignment mapping in Phase II of project is contingent upon significant channel changes during the 1997/98 and 1998/99 flood seasons. Any work conducted on private land will take place only after permission to enter has been granted by the landowner.

#### IV. Costs and Schedule to Implement Proposed Project

##### a. Budget Costs

Project Phase and Task	Direct Labor Hours	Direct Salary and Benefits	Overhead Labor (General, Admin. and fee)	Service Contracts	Material and Acquisition Contracts	Misc. and Other Direct Costs	Total Costs
<b>Phase I</b>							
Prototype Web Site	80	3,300	2,600		5,000		10,900
Development of interactive GIS	240	9,900	7,900			1,800	19,600
Development of standard metadata	200	8,200	6,700				14,900
Data updates	400	16,500	13,200			2,400	32,100
Erosion projections	200	8,200	6,600				14,800
Field data collection: bank face/exotic species	1,000	41,200	33,000			3,500	77,700
Map development with GIC	80	3,300	2,600				5,900
<b>Phase I Total:</b>	<b>2,200</b>	<b>90,600</b>	<b>72,600</b>		<b>5,000</b>	<b>7,700</b>	<b>175,900</b>
Complete interactive GIS Web Site	460	19,000	15,200			1,500	35,700
Update ownership	220	9,100	7,300			900	18,700
Insert new/updated data	400	16,500	13,200			1,400	29,700
Develop new channel data & insert into GIS	240	9,900	7,900		12,000	1,000	29,700
Map development with GIC	180	7,400	5,900				13,300
<b>Phase II Total:</b>	<b>1,500</b>	<b>61,900</b>	<b>49,500</b>		<b>12,000</b>	<b>4,800</b>	<b>128,200</b>
<b>PROJECT TOTAL:</b>							<b>\$304,100</b>

## **b. Schedule milestones**

This schedule assumes funding to begin November, 1997

Task	Begin	Complete
<b>Phase I</b>		
Prototype Web Page	November 1997	March 1998
Development of interactive GIS	November 1997	November 1999
Development of standard metadata	November 1997	November 1999
Data updates	November 1997	November 1999
Develop erosion projections	November 1997	November 1998
Field data collection: bank face	May 1999	August 1999
Field data collection: exotic plant species	April 1998	September 1998
Map development with CSUC Geographic Information Center	November 1997	November 1999
<b>Phase II</b>		
Complete Web Site	March 1998	November 1999
Update ownership information	November 1998	November 1999
Insertion of new and updated data layers into GIS	November 1998	November 1999

## **c. Third Party Impacts**

It is not anticipated that there will be any third party impacts associated with this project. Any field data collection conducted on private land will occur only after access is granted.

## **V. Applicant Qualifications**

DWR, Northern District has developed the existing Sacramento River Geographic Information System, while serving as staff to the Upper Sacramento River Fisheries and Riparian Habitat Management (SB1086) Program. Engineers and environmental specialists within DWR Northern District are knowledgeable of and experienced with a wide range of GIS-related issues, hardware and software. Department geologists and environmental specialists are experienced in field collection of biological, physical and geological data, and

in the use of differential GPS.

Program Manager Stacy Cepello has taken the lead in technical support for the Upper Sacramento Fisheries and Riparian Habitat Management Program, including the development of the Sacramento River Geographic Information System. Cepello has conducted research on the relationship between riparian forest species, flood frequency, and substrate conditions, has managed numerous program relating to Sacramento River and tributary watershed issues, and has provided technical support to a variety of watershed efforts.

Joyce Lacey, Environmental Specialist IV has been a botanist with the California Department of Water Resources for over fifteen years. Lacey has extensive experience in vegetation mapping, plant taxonomy, and vegetation studies, and conducts wetland delineations statewide for DWR.

Shawn Pike, Associate Engineer, has taken the technical lead on developing wetlands data for the Central Valley as part of the Central Valley Habitat Wetlands Joint Venture, in cooperation with the U.S. Fish and Wildlife Service. Pike has experience with spatial data management and analysis using a variety of GIS software, including ArcInfo, ArcView, Geo/SQL, Spatial Analyst, and ERDAS. His experience includes overlay analysis, data conversion, database management, and GIS project management.

Julie Cunningham, Environmental Specialist III, is a geographer who has worked as staff for the SB1086 Program for over two years. Cunningham is familiar with a wide range of resource issues along the Sacramento River. She coordinated development of the draft *Sacramento River Conservation Area Handbook* and has assisted with the development of the Sacramento River Geographic Information system, and the development of resource maps for the Sacramento River watershed. Cunningham has collected field data using GPS units, and has assisted with vegetation monitoring surveys.

Rodney Sparks, Student Assistant, is currently studying engineering at Shasta College. Sparks is knowledgeable in ArcView, ArcCAD and Avenue scripts, and developed figures on Sacramento River resources for the *Sacramento River Conservation Area Handbook*.

#### **IV. Compliance with standard terms and conditions**

The applicant is in agreement with, and will comply with, all standard terms and conditions, including the Interagency Agreements and standard clauses included in the Request for Proposals.